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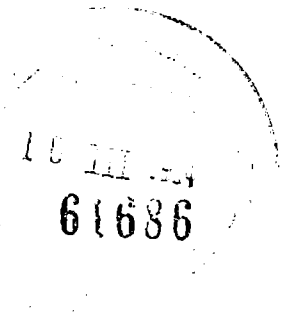
IMPACT ASSESSMENT OF GROUND WATER UTILIZATION ON THE RURAL INHABITANT'S FERTILITY IN THE NORTH OF THAILAND



PISIT SUKREEYAPONGSE
Faculty of Environment and
Resource Studies
Mahidol University
Bangkok, Thailand

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Research Team:

PISIT SUKREEYAPONGSE

SAKDA SUPAPONGPICHATE

TAWATCHAI ARTHORNTHURASOOK

AREE WIBOONPONGSE

Abstract

The study, Impact Assessment of Ground Water Utilization on the Rural Inhabitant's Fertility in the North of Thailand, is a case study of Buag Kang Village, Buag Kang Sub-district of San Kampaeng District, Chiang Mai Province. All married couples at reproductive age were interviewed according to an interview schedule. Methods of statistical analysis included Chi Square, Analysis of Variance and Multiple Classification.

Analysis of data shows that the use of ground water has led to economic change which includes land utilization and increase in productivity among the ground water users. The changes, in turn, induce returned migration to the ground water users' families as the need for labor increases.

The relationship between the use of ground water and recent fertility was measured by children ever born 3 years ago. The result of Multiple Classification Analysis shows that the ground water users have lower fertility than the non-users. There are also other factors affecting fertility such as income earned by wife's working outside home, family income, wife's education, practice of family planning and main occupation of the family. Data also show that the ground water users have a stronger preference for a smaller family size than the non-users, whether preference is measured by "too few", "too many" and "ideal" number of children.

Table of Contents

List of Tables

Chapter I

Introduction

1.1 Background

Thailand is a developing agricultural country with a population of 47.3 million in 1980.[1] The great majority of the Thai population lives in the rural areas. Agriculture is the major source of national income.[2] Successful development of the country as a whole depends on the improvement of the standard of living of the rural people.

Rapid population growth, particularly in the rural areas, has been recognized as a barrier to national social and economic development. The Third and the Fourth National Five-Year Plans clearly announce population policies and programmes. Even though the rate of population growth has been considerably reduced, it is still high, about 2.1 per cent annum.[3] The increase in the size of population has significantly reduced the size of land holdings and has resulted in an increase of surplus labor in the rural sector. Consequently, other occupations need to be found. Those who stay in the villages must find ways to increase their earnings and to improve productivity of the land by using new technology, e.g., fertilizer, pesticide, new variety of rice and cash crops suitable to their localities, and labor - saving machines at certain stages of production.

The national economic and social development plans have stipulated as policies the improvement of agricultural irrigation systems such as

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1 Institute for Population and Social Research, "Southeast Asian Population 354 Million" Population and Development, Vol 1, No 2, Bangkok: Mahidol University, 1981, p 3.

2 United Nation, Economic and Social Commission for Asia and Pacific, Country Monograph Series No 3: Population of Thailand, Bangkok: United Nations, 1976, pp 102-118.

3 Suchart Prasith-rathsint and Tawatchai Arthornthurasook, A Feasibility Study of Reducing the Population Growth Rate of Thailand to 1.5 per cent Per Annum by the End of the Fifth Five-Year Plan: A Technical Demographic Analysis, Bangkok: National Institute of Development Administration, 1978, p 2.

the construction of dams, reservoirs and irrigation canals. The significance of agricultural development has been recognized by the government and a budget has been recently allocated for 400 small irrigation projects in 57 provinces. However, in some areas that cannot be reached by the irrigation systems, the people have learnt to make use of ground water resources for agriculture for over a decade.

1.2 Significance of the Research Problem

The utilization of ground water makes it possible for the farmers to rotate their crops all year round instead of farming only once a year. Their success has caught the attention of the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives and Division of Ground Water, Department of Mineral Resources, Ministry of Industry. Since then, they have been involved in drilling ground water wells for agriculture, in addition to household consumption. The drilling first started at Ban Na Ka, Muang District, Udon Thani Province and spread to other provinces, including Chiang Mai, Lampun, Phitsanulok, Phichit, Kamphaengpetch, Sukho Thai, Saraburi, Khon Kaen, Songkhla, Pattani and Nakhon Ratchasima.[1]

The utilization of ground water has made it possible for the farmers to farm their land throughout the year. Ground water utilization is expected to have an impact on labor employment, and includes changes in social and economic conditions, migration and fertility behavior of the rural families utilizing ground water.

1.3 Conceptual Framework for Research Planning

The conceptual framework used in the study is as follows: Agricultural development which is based on the utilization of ground water resources affects changes in social and economic conditions and components of population. The ability to do multiple cropping all year round will enable the rural families to make full use of family labor, including women and children. This will raise household income, and consequently the standard of living, in turn, will affect the rate of migration from rural to urban areas or from rural to the forest land. As the utilization of ground water affects the use of women and children on the farm, it inevitably has an impact on women's fertility.

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1 Somchai Wongsesawatdi, Ground Water for Agriculture, Bangkok: Ministry of Industry, 1979, pp 1-5.

1.4 Objectives of the Study

1. To make a comparative study on fertility behavior and attitudes of those who use ground water and those who do not;

2. To compare the fertility level of women who are employed in agriculture all year round and those who are employed during the rainy season, and

3. To study the impact of multiple cropping on migration out of agricultural areas during the past 5 years.

It is expected that the research findings will be useful for assessing the use of ground water on fertility of the rural population. Data can also be used to formulate policies for developing agriculture in the rural areas that are the source of water supply.

1.5 Hypotheses

The hypotheses of this research project are:

1. Those who utilize ground water resources earn more income and have a smaller family size than those who do not;

2. Women who are engaged in agricultural activities all year round are likely to have fewer children than those who are not; and

3. Utilization of farm labor all year round reduces migration.

1.6 Scope of the Study

The present study will collect data from Mu Ban Buag Kang, Kampaengsean district, Chiang Mai province with the use of an interview schedule. The ever-married couples in 198 households or about 206 couples will be interviewed.

1.7 Method of Data Collection

After a review of the literature and development of the interview schedule, a preliminary field survey was conducted to pretest the questionnaire and to study the general characteristics of the villages including pattern of settlements, land use, agricultural technology, agricultural labour utilization, and other social and economic characterisitcs of the villages.

Before the actual field work, the interviewers were recruited and trained so that they would understand the objectives of the research project and these of the questionnaire as well as techniques of interview and data collection.

1.8 Data Processing and Analysis

Once the data were collected, they were field edited. Coding instruction was developed. Data were coded and then keypunched.

Multivariate analysis techniques are used to analysis the relationships between a dependent variable and a set of independent variables. Specifically, the techniques used are multiple classification analysis, analysis of variance and chi square test.

Chapter II

Selected Social, Economic and Demographic Characteristics of the Village and Its Population

The research project is a case study of Buag Kang village situated on the largest and most developed plain in the North known as Chiang Mai Valley. In order to understand various factors related to the linkage between agriculture and fertility, the general context in which the relationship takes place is provided. This includes a description of general characteristics of the Chiang Mai Valley, settlement pattern, general, social, economic and demographic characteristics of the village population, land use and technology of the agricultural production.

2.1 The Chiang Mai Valley

The Northern region of Thailand covers 170,000 square kilometres or 937,500 rai (2.5 rai = 1 acre) or about one-third of the country's area. The region can be divided into 2 sub-regions. The upper sub-region covers 90,933 sq.km., or about 51.85 percent of the region's area. Chiang Mai province is the economic center of this sub-region. The lower sub-region covers 84,900 sq.km. or about 48.15 per cent of the region's area and Phitsamulok is its economic center.(1)

The Northern region is mostly hilly and mountainous. The inter-mountain plain area used for agriculture and human settlement consists of 21 per cent of the area.(2) The major crops are rice,

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1 National Economic and Social Development Board, Development Guidelines for the Northern Region and Provinces during the Fourth National Economic and Social Development Plan 1972-1981 (Bangkok : National Economic and Social Development Board, 1976), pp. 5-6.

2 Ibid

tobacco, yellow beans, ground beans and so on. Some of its population cultivate crops on the hillside. Due to high population density and population increase, people expanded their agricultural land by encroaching onto the forest using slash-and-burn farming.

The general geographical characteristics of the region have made it the source of water supply for the country. The major rivers in the country, namely, Ping, Wang, Yom, Nan, originate in the region and merge to become the Chao Praya River which brings water to farm lands in the Central region.

The village under study is in the upper sub-region of the North which has a major plain known as the Chiang Mai Valley. The Valley covers 1,500 sq.km or 931,500 rai. Its area surrounds Chiang Mai City and Lamphun Province, about 110 kilometres long from North to South along the Ping River's stream and 30 kilometres wide.(1) As the Ping River flows through the Valley, the land is very fertile and suitable for farming.

The climate of Chiang Mai Valley is similar to that of high land which is far from the sea. Temperature varies significantly by season. There are 3 seasons in a year, i.e., rainy season, winter and summer. The rainy season begins in mid-May and ends in September or October. The yearly average rainfall is 1,200 m.m.(2) The winter season begins in October and ends in February and is affected by the monsoon winds from Mainland China. The summer begins in February and ends in Mid-May, affected by South-Westerly winds.

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1 Rapeepun Sektheera and Alan R. Thodey, Optimal Multiple Cropping Systems for the Chiang Mai Valley, (Chiang Mai: Faculty of Agriculture, Chiang Mai University, 1974), p. 1.

2 Faculty of Environment and Resource Studies, Report on the Preliminary Environmental Survey of the Northern Region (Bangkok: Mahidol University 1976) Mimeograph, p. 2.

The distribution of rainfall in the region to some extent has an impact on the type of agricultural technology adopted by the farmers in the region. In an area where irrigation does not exist, people depend on either rainfall or ground water. Even in the same area, only certain parts receive water from the irrigation project. Buag Kang Village, in the middle of the San Kampaeng District (which has an irrigation system) does not receive any water from the irrigation system. The villagers depend on rain and ground water.

Soil in Buag Kang village is of the Hang Dong Soil Series; the top soil is characterized by loam to clay loam and the subsoil by clay loam to sandy clay loam. It has a moderate amount of organic matter and alkaline content of 6.0 - 7.0. The soil structure is predominantly fine to medium, subregular rocky to a depth of 1 meter or more. Consistency is hard when dry, and firm, slightly sticky and slightly plastic when wet. Scattered iron-manganese concentrations may occur in the deeper soil. Soil drainage is relatively poor.(1)

2.2 General Characteristics of the Chiang Mai Valley Population

In 1960, the population of the Northern region was 5,723,000. It increased by 748,863 persons in 1970. The annual growth rate was 2.7 per cent. Chiang Mai Province itself in 1975 had a population of 1,096,199 as compared to 1,023,223 in 1971. The annual growth rate is 1.4 per cent, a relatively low growth rate,(2) indicating a fertility reduction in the past. As for Buag Kang, in 1971 the total number of households was 160 and 1980 it increased to 198 households with the population of 912.(3)

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1 F.J. Deut and Manu Onakupt, Soil Series Survey of the MERS Chiang Mai Study Area, "Report SSE-SO-1966, (Bangkok: Soil Survey Division, Land Development Department, 1966).

2 The National Social and Economic Development Board, Development Guidelines for the National Region and Provinces during the Fourth National Economic and Social Development Plan 1972-1981 (Bangkok: National Economic and Social Development Board, 1976) p. 23.

3 Aree Wiboonpongse, Kitipongse Wuthichamnong and Pruke Yibmuntasiri, Economic Analysis of Ground Water Use in Northern Thailand: A Case Study of Buag Kang Village, San Kampaeng District, Chiang Mai Province. (Chiang Mai: Chiang Mai University, 1979) p. 6.

2.3 Characteristics of the Settlement

1. Village Location

Buag Kang is 15 kilometres away from Chiang Mai City and about 3 kilometres from San Kampaeng District. An asphalt surfaced road runs about 2 kilometres from the District to the village. The remaining distance of 1 kilometre of road is covered by a laterite road. The villagers use tricycles and minibuses regularly scheduled as means of transport between the village and the town.

2. Settlement Pattern and Infra-structure

As for the settlement pattern of the village, most of the houses are located in a block along both sides of the road, which runs through the middle of the village. Only a few houses are on the rice field.

The village road consists of laterite soil, with inlets into houses. Most of the houses are surrounded by rice fields. Most houses are one-floored and raised above the ground, as commonly found in other rural areas. The ground under the house is used for multi-purposes, such as a recreational area or for economic activities such as cloth-weaving, wood-carving and keeping farm equipment. The construction materials vary according to the economic status of the owners. Most of the houses are roofed with corrugated zinc or tiles. The actual houses are made of wood, mostly teak, which is easily found in the North. Houses of the poor are roofed with thatch and the walls are made of woven bamboo. Those who are relatively well-off prefer modern houses, half brick and half wood. The first floor is made of bricks and the second floor of wood, and the roofs are made of corrugated tiles. Each house is fenced by bamboo.

Buag Kang has had electricity since 1973. As a development input, it has caused social and economic change in the village. The obvious change is that it has provided the female population with opportunities to be engaged in income-earning activities such as cloth-weaving and ready-made cloth making. Women can work longer hours.(1) Several houses

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1 Suchart Prasith-rathsint, Tawatchai Arthornthurasook, Pisit Sukreeyapongse, A Micro Socio Economic Analysis of Thai Fertility Behavior: A Rural Family Perspective, the Findings. (Bangkok: Mahidol University, 1978), p. 77.

have been converted into places for making ready-made clothes; some employ 10 to 20 people. Furthermore, with electricity, the villagers have the opportunity to listen to the news and watch television programs. They also use electricity for pumping water to irrigate their rice fields and for household consumption.

Most of the villagers in Buag Kang village obtain water from their own dug wells. They do not store rain water for consumption. There are about 126 wells in the villages, 105 of which are ordinary dug wells. The rest are drilled and pumped by electricity.

In terms of infra-structure, the village has a primary school, a community newspaper reading place, and two temples for their religious ceremonies. It has no health service center. Consequently the villagers have to go to the nearby villages, but usually they prefer going to receive their medical and health services in Chiang Mai City as it is relatively convenient to get to and is not too far away.

2.4 Social, Economic and Demographic Characteristics of the Village Population

The structure, size and composition of a family are one of the factors related to labor utilization and reproductive behavior. A family with a relatively large proportion of economically active age members is in a better position to raise its standard of living than the one with a smaller proportion of economically active age members. The extent to which a family can exploit economic opportunities also has some bearing on the family members' decision on family size.

1. Type and Size of Families

In Buag Kang village, among 198 families, only 8 of them are extended families. Each of them has two couples. The average number of members of a family is 4.43. Those who used ground water generally had more members than those who did not (Table 1).

Selected Characteristics of the Village Population

2. Age

With respect to the age of the household heads, it is about 42 years. There is no significant difference between users and non-users of ground water.

As for women, the average current age is 40.5 years, which is 2 years less than that of the household heads. There is also no significant difference between the non-users and the users, although the average age of the non-users is higher than that of the users of ground water, 40.8 years as compared to 39.5 years.

3. Education

On the average, the household heads completed compulsory education of 4 years. The non-users averaged 4.2 years as compared to 3.8 years of schooling for the non-users. The difference is not significant. Table 2 shows the distribution of household heads by level of education.

Table 1: Selected Characteristics of the Village Population

Selected Characteristics		Use of Ground Water			Stat. Sig. Difference
		Non-User	User	Total	
Average Number of Family Member	$\bar{X}$	4.2885	4.8600	4.4272	
	SD	1.8940	1.4144	1.8030	$p < .05$
	N	156	50	206	
Head's Current Age	$\bar{X}$	41.8085	41.6453	41.7672	
	SD	14.1052	14.0599	14.0565	$p > .05$
	N	141	48	189	
Female Current Age	$\bar{X}$	40.8092	39.5400	40.4950	
	SD	14.8408	13.4289	14.4818	$p > .05$
	N	152	50	202	
Male Education	$\bar{X}$	4.2279	3.8261	4.1264	
	SD	2.2043	0.6075	1.9356	$p > .05$
	N	136	46	182	
Female Education	$\bar{X}$	3.7692	3.8478	3.7884	
	SD	1.4617	0.6656	1.3118	$p > .05$
	N	143	46	189	
Average Number of Live Births	$\bar{X}$	2.8462	3.2400	2.9417	
	SD	2.4314	2.5520	2.4607	$p > .05$
	N	156	50	206	
Average Number of Living Children	$\bar{X}$	2.6645	2.6600	2.6634	
	SD	2.2942	1.9442	2.2094	$p > .05$
	N	155	50	205	
Average Number of Members Under 15 years	$\bar{X}$	0.987	1.04	1.00	
	SD	1.03	0.88	.998	$p > .05$
	N	156	50	206	
Average Number of Members 15-60 years	$\bar{X}$	2.92	3.46	3.05	
	SD	1.47	1.30	1.45	$p < .05$
	N	156	50	206	
Average Number of Members 60 years and Over	$\bar{X}$	0.39	0.48	0.41	
	SD	0.69	0.71	0.69	$p > .05$
	N	156	50	206	
Number of Reproduction Age Women who were Married	$\bar{X}$	0.78	0.82	0.79	
	SD	0.49	0.48	0.48	$p > .05$
	N	156	50	206	
Marital Status of Reproductive Age Women		100	100	100	
Currently married		87.8	96.0	89.8	$p > .05$
Currently not married		12.2	4.0	10.2	

Table 2: Percentage Distribution of the Household Heads by Level of Education

Level of Education	Use of Ground Water		
	Non-User	User	Total
No schooling	10.8	6.1	9.6
1-3	8.8	14.3	10.2
4	75.0	79.6	76.1
Above 4	5.4	-	4.1
Total	100	100	100
Number	148	49	197

$X^2 = 4.63719$ $p > .05$

Even though the percentage of women who completed compulsory education is higher than that of the household heads, fewer of them went beyond the primary education. Consequently the average number of years of schooling for women is less than that of men. Table 3 shows the distribution of women by the level of education.

Table 3: Percentage Distribution of Wives of the Household Heads by Level of Education

Level of Education	Use of Ground Water		
	Non-User	User	Total
No Education	12.9	8.0	11.7
1-3	7.1	10.0	7.8
4	78.7	82.0	79.5
Above 4	1.3	-	1.0
Total	100	100	100
Number	155	50	205

$X^2 = 1.8812$; $p > .05$

4. Number of Live Births

Insofar as fertility is concerned, an average number of live births of a Buag Kang family is 2.9, which is relatively low. Those who used ground water had 3.2 live births as compared to 2.8 live births for non-users of ground water.

5. Number of Living Children

However, the ground-water users had about the same number of living children than the non-users, an average of 2.66 children, probably due to better health of the users' families.

6. Number of Persons by Age-Group

As for the number of persons under 15 years of age, each family on the average has 1 person. The average number of non-economically active people of the ground water users' families is slightly greater than that of the non-users'. The user-group also has a larger number of economically active persons than that of the latter, 3.46 as compared to 2.9 persons. The difference is statistically significant.

As for the number of persons over 60 years of age, the user group also has as a slightly higher average than the non-user group but the difference is not statistically significant.

7. Number of Reproductive Women

On the average, a family in Buag Kang village has about 1.3 women of reproductive age. The ground water users' families have a larger number of women of reproductive age than the non-users'.

Among the reproductive age women, the majority of them, on the average 89.8 per cent, are currently married. The ground water user group has a greater percentage of women currently married.

8. Primary and Secondary Occupations

The majority of Buag Kang population is engaged in agriculture as their primary occupation. About one-fourth are engaged in non-agricultural occupations. Those who do not use ground water are more

diversified in their occupations than those who do (Table 4). The non-users of ground water are found laboring and in civil service in a greater percentage than the users.

As for secondary occupations, the non-user group is also found to have more secondary occupations than the users, probably due to the fact that the latter can engage themselves throughout the year in agriculture.

Table 4: Primary and Secondary Occupations of Buag Kang Population by Ground - Water Use

Occupation	Primary			Secondary		
	Non-User	User	Total	Non-User	User	Total
Farming	73.5	82.0	75.6	-	-	-
Sewing	2.6	4.0	2.9	13.5	16.0	14.1
Wood-carving	1.9	-	1.5	6.5	4.0	5.9
Construction	2.6	6.0	3.4	16.1	8.0	14.1
Landlord	2.6	2.0	2.4	-	-	-
Hair-cut	-	2.0	0.5	-	-	-
Trade	3.9	2.0	3.4	7.1	8.0	7.3
Hired Labor	7.1	-	5.4	7.1	8.0	7.3
Civil Service	5.8	2.0	4.9	-	-	-
Cloth-Weaving	-	-	-	9.7	6.0	8.8
None	-	-	-	40.0	50.0	42.4
Total	100	100	100	100	100	100
Number	155	50	205	155	50	205

9. Size of Farm Land

Among the farmers, the average size farm is 8.3 rai (2.5 rai = 1 acre). The size of the farm of ground-water users is significantly larger than that of the non-users, 10.8 rai as compared to 7.6 rai. The total annual rice productivity of the farmer is also higher than that of the latter, 499.2 tangs as compared to 367.1 tangs (Table 5).

10. Annual Income

One the average a family in Buag Kang earned baht 22,538 a year (23 baht = US $ 1.00). A family that used ground water made baht 26,480 a year as compared to baht 21,275 a year made by a non-user family.

Before marriage, women earned an income of baht 277 a month. Those who were married to the users of ground water earned less than those among the non-users. The former also currently earned less than the latter. The users of ground water reported loss of income due to childbearing higher than did the non-users. All the differences are, however, not statistically significant.

As for the income earned by children, the users of ground water reported they received earnings from children of about baht 5,264 a year as compared to baht 2,764 a year received by the non-users from their children, while even the latter had more income-earning children.

Fertility-Related Factors

11. Age at Marriage

The average age at marriage of the women in the study is 20.88 years. Women in the group of ground water users were married at a later age than those in the non-user group, 21.2 as compared to 20.8 years of age.

12. Duration of Marriage

The difference in age at marriage reflects the difference in duration of marriage. The average duration is 19 years; that of the user group is 19.1 years and the non-user group is 18.9 years.

13. Open-birth Interval

The average open-birth interval is 10.5 years, that of the user group is slightly shorter than that of the non-user group 10.18, as compared to 10.64 years.

14. Overall Average Birth Interval

The overall average birth interval is 26.5 months. The user group has a slightly shorter interval than the non-user group, 25.4 as compared to 26.8 months.

Table 5: Selected Economic Characteristics of Buag Kang Families by Ground-Water Use

Characteristics		Use of Ground Water			Stat. Sig.
		Non-User	User	Total	
Size of Farm Land (rai)	$\bar{X}$	7.56	10.77	8.32	
	SD	9.28	8.93	9.28	$P < .05$
	N	151	47	198	
Rice Yield (Tang)	$\bar{X}$	367.10	499.16	398.82	
	SD	750.96	378.60	681.85	$P < .05$
	N	155	49	204	
Annual Income (Baht)	$\bar{X}$	21,275.82	26,479.59	22,538.12	
	SD	14,140.94	13,356.55	14,100.34	$P < .05$
	N	153	49	202	
Monthly Income Earned Before Marriage (Baht)	$\bar{X}$	283.89	258.80	277.42	
	SD	729.58	246.60	640.28	$P > .05$
	N	144	50	194	
Monthly Income Earned at Present (Baht)	$\bar{X}$	438.93	364.20	420.15	
	SD	972.87	489.62	876.27	$P > .05$
	N	149	50	199	
Monthly Income Loss Due to Child Bearing (Baht)	$\bar{X}$	165.10	175.66	167.71	
	SD	236.06	219.29	231.51	$P > .05$
	N	151	50	201	
Annual Income Received From Children	$\bar{X}$	2,764.90	5,264.00	3,386.57	
	SD	6,403.12	10,108.21	7,546.92	$P < .05$
	N	151	50	201	
Number of Children Making Income	$\bar{X}$	0.44	0.66	0.50	
	SD	0.86	0.74	0.84	$P > .05$
	N	156	50	206	

15. Abortion Experience

When asked about abortion experience, induced or spontaneous, 90 per cent of the respondents reported no experience. Those who used ground water for cultivation reported a higher frequency of abortion than the non-users, 14 percent as compared to 9 percent.

16. Current Pregnancy

Currently 3.4 per cent of the female respondents are pregnant. The percentage of currently pregnant women in the non-user group is greater than that of the user-group, 3.8 per cent as compared to 2 per cent.

Table 6: Fertility-Related Factors by Ground-Water Use

Factors		Use of Ground Water			Stat. Sig. Difference
		Non-User	User	Total	
Female Age at First Marriage	$\bar{X}$	20.8052	21.1200	20.8824	
	SD	3.1748	2.7968	3.0827	P > .05
	N	154	50	204	
Open-birth Interval (year)	$\bar{X}$	10.6397	10.1837	10.5189	
	SD	8.9960	7.1899	8.5383	P > .05
	N	136	49	185	
Overall Average Birth Interval (month)	$\bar{X}$	26.8444	25.4082	26.4620	
	SD	17.5962	13.2097	16.5195	P > .05
	N	135	49	184	
Duration of Marriage	$\bar{X}$	19.0789	18.880	19.0297	
	SD	13.9125	12.5302	12.5533	P > .05
	N	152	50	202	
Experience in Abortion					
Never		91.0	86.0	89.8	
Ever		9.0	14.0	10.2	
Total		100	100	100	P > .05
Number		155	50	205	
Current Pregnancy					
Not Pregnant		96.2	98.0	96.6	
Pregnant		3.8	2.0	3.4	
Total		100	100	100	P > .05
Number		156	50	206	

17. Fertility Measures

With respect to the number of children they considered "too few", "too many", "ideal" and "generally appropriate" the user group gave a smaller number of them all, compared to the non-user. This indicates the preference for a smaller family size of the user group (Table 7).

Table 7: Fertility Measures by Ground-Water Use

Fertility Measures		Use of Ground Water			Stat. Sig.
		Non-User	User	Total	
Number of Children Considered "too few"	$\bar{X}$	1.1503	1.0400	1.232	
	SD	0.6153	0.2828	0.5537	P >.05
	N	153	50	203	
Number of Children Considered "too many"	$\bar{X}$	6.2418	5.6600	6.0985	
	SD	2.1027	2.1910	2.1342	P >.05
	N	153	50	203	
Ideal Number of Children	$\bar{X}$	2.1634	2.1000	2.1478	
	SD	0.7562	0.7626	0.7564	P >.05
	N	153	50	203	
Generally Appropriate Number of Children	$\bar{X}$	0.3399	0.2449	0.3168	
	SD	0.6403	0.4800	0.6056	P >.05
	N	153	49	202	
Desire for Additional Children	$\bar{X}$	2.4935	2.2800	2.4412	
	SD	0.8185	0.7835	0.8134	P >.05
	N	154	50	204	
Appropriate First Birth Interval	$\bar{X}$	1.3613	1.2800	1.3415	
	SD	1.3284	1.3856	1.3396	P >.05
	N	155	50	205	

They are also less frequent in their desire for additional children compared to the non-users. However, the former preferred to have the first birth at a shorter interval than the latter.

18. Decision on Having Children

Regarding the decision on having children, about two-fifths of the couples reported they jointly made the decision, another two-fifths said they did not make any decision or any plan, but let the nature take its own course. Among those who made the decision, wives played a major role in the decision in a greater percentage than their husbands (Table.8).

Those who used ground water jointly made a decision on having children in a larger percentage than those who did not, 46 per cent as compared to 38 per cent. The percentage of those who made plans to have children is also found to be greater among the users than the non-users.

19. Problem with the Current Number of Children

When asked whether they had any problem with the current number of children, the majority of them, 56 per cent, said they had no problem. However, as many as 35.6 per cent said they had economic problems. The rest said they had health and emotional problems and problems in taking care of their children.

Table 8: Who Made Decision on Having Children?

Who Made Decision	Use of Ground Water		
	Non-User	User	Total
No Decision	38.7	36.0	38.0
Husbands	8.4	4.0	7.3
Wives	14.8	14.6	14.6
Jointly made	38.0	46.0	40.0
Total	100	100	100
Number	155	50	205

Data also show that the percentage of those who used ground water and had problems with the current number of children is less than that of those who did not use ground water (Table 9). The former also had economic problems less than the latter.

20. Benefits of Having Children

With respect to the benefits of having children, the majority of the couples said they gained benefits from having children as their children helped them in household and occupational work. The percentage of those who used ground water and gained benefits from having children is greater than that of the non-users (Table 10).

Table 9: Whether the Current Number of Children Causes Any Problems?

Any Problem	Use of Ground Water		
	Non-User	User	Total
No Problem	58.5	51.0	56.5
Economic Problems	35.6	34.7	35.3
Other Problems	5.9	14.3	8.2
Total	100	100	100
Number	135	49	184

Table 10: Benefits of Having Children

Benefit	Use of Ground Water		
	Non-User	User	Total
No benefit	46.1	34.0	43.1
Household work	24.0	26.0	24.5
Occupational Work	3.2	-	2.5
Both household and Occupational work	26.1	40.0	29.9
Total	100	100	100
Number	154	50	204

21. Average Number of Live Births by Age

Data show that the average number of live births increased with age, i.e., those who were younger had fewer children than those who were older (Table 11). In general the users of ground water had fewer children than the non-users.

22. Recent Fertility

Regarding recent fertility as measured by the number of children under 3 years of age, data show that the non-users had higher fertility than the users during the past 3 years (Table 12).

Table 11: Average Number of Live Births by Age Group

Age - Group		Use of Ground Water		
		Non-User	User	Total
19 and under	$\bar{X}$	0.75	0.0	0.60
	SD	1.5	0.0	1.34
20 - 29	$\bar{X}$	0.74	1.14	0.85
	SD	0.57	0.77	0.65
30 - 39	$\bar{X}$	2.31	2.30	2.31
	SD	1.75	0.67	1.56
40 - 49	$\bar{X}$	3.82	3.70	3.80
	SD	2.33	1.06	2.09

Table 12: Average Number of Children Under 3 Years of Age by Age-group

Age-Group		Use of Ground Water		
		Non-User	User	Total
19 and under	$\bar{X}$	-	-	-
	SD	-	-	-
20 - 29	$\bar{X}$	0.47	0.57	0.50
	SD	0.56	0.51	0.55
30 - 39	$\bar{X}$	0.23	0.00	0.178
	SD	0.49	0.00	0.44
40 - 49	$\bar{X}$	0.12	0.00	0.09
	SD	0.48	0.00	0.42

23. Knowledge and Practice of Family Planning

The finding on recent fertility is also consistent with the distribution of respondents by knowledge, attitude and practice of family planning. Table 13 shows that the percentage of ground water users who know and practice family planning is greater than that of the non-users. The major reasons for practicing family planning are that they have the number of children wanted, and they face economic

problems. Those who did not practise family planning reasoned that they had not had any children, or the sex of children they preferred. Some said they were afraid of the side effects of birth control. However, a great percentage of them did not specify the reason for not practising family planning.

24. Migration

Data also show that there are both in and out-migrations in the village under study, but the village was losing its population in the process. The households that did not use ground water during the dry season lost their numbers in a greater percentage than those that used ground water (Table 14).

Table 13: Knowledge and Practice of Family Planning

KAP	Use of Ground Water		
	Non-User	User	Total
Knowledge	100	100	100
Don't Know	19.4	8.0	16.6
Know	80.6	92.0	83.4
Not Practice	56.8	48.0	54.6
Having no child, sex preference unfulfilled,	9.0	6.0	8.3
Poor health, few of side-effect	5.2	4.0	4.9
Want more children	2.6	2.0	2.4
Unspecified	40.0	36.0	39.0
Practice	43.2	52.0	45.4
Enough number	25.2	28.0	25.9
Economic Problems	15.5	12.0	14.6
Other reasons	2.5	12.0	4.9
Total	100	100	100

Table 14: Migration by Use of Ground Water

Migration	Use of Ground Water			Stat. Sig. Difference
	Non-User	User	Total	
In-Migration Rate	7.05	12.0	8.25	P > .05
Out-Migration Rate	15.38	16.0	15.53	P > .05

Chapter III

Impact of Ground Water Utilization on Fertility

In the previous chapters, general characteristics of the two populations, the ground water users and non-users, have been analyzed. The present chapter deals with the analysis of fertility change due to the utilization of ground water. The techniques of analysis used are analysis of variance and multiple classification analysis.

3.1 Dependent Variable

The dependent variable chosen for analysis of the impact of ground water use on fertility is the number of children ever born three years ago instead of the total number of living children or children ever born. The last two variables are cumulative fertility experience a couple had before they used ground water. The villagers have, on the average, used ground water for 4 years. The impact of its use should be what happens after. Thus recent fertility as measured by the number of children ever born three years ago is an appropriate dependent variable.

3.2 Independent Variables

The independent variables included in the analysis are:

1. Use of ground water
2. Abortion experience
3. Wife's education
4. Family's main occupation

3.3 Covariates

The variables used as controlling variables are:

1. Wife's income
2. Family's income
3. Engagement in secondary occupation
4. Average birth interval
5. Family planning practice

3.4 Significance of the Independent Variables and Covariates

The use of ground water will affect the use of female labor which, in turn, will affect fertility. Pregnancy wastage and spontaneous abortions will also affect women's desire for children. Education of the wife of the household head is likely to increase knowledge and acceptance of family planning and family size. Household heads who are engaged in different occupations are likely to have different levels of fertility.

As for the significance to fertility of the controlling variables or covariates which include wife's income, family's income, and engagement in secondary occupation, average birth interval and family planning practice, it is expected that wife's income will have a negative impact on fertility as she has to spend her time to earn income and less time to raise children. Similarly, family's income will also be negatively related to fertility as household members will have to spend more time on income generating activities. Engagement in secondary occupation also increases the value of time and consequently conflicts with time-consuming childbearing. Birth interval and family planning will negatively affect fertility. These variables need to be controlled if one wants to study the impact of ground water use on fertility.

3.5 Multiple Classification Analysis of Recent Fertility

The result of multiple classification analysis shows that the families of ground water users generally have lower fertility than those of the non-users even when other independent variables and covariates are controlled (Table 15).

Data also show that women who experienced pregnancy waste had lower fertility than those who never did, but the difference is not statistically significant (Table 16).

It is interesting to note that families whose main occupation is agricultural have lower recent fertility than those whose main occupation is not agricultural. This is probably due to the fact that the former had higher fertility when they initially started the families than the latter. Thus, once the former had almost achieved the number

Table 15: Multiple Classification Analysis of Recent Fertility

Variable and Category		Unadjusted		Adjusted for Independents		Adjusted for Independents and Covariates	
(Grand Mean = 0.22)	N	Dev'n	Eta	Dev'n	Beta	Dev'n	Beta
Use of Ground Water			0.08		0.06		0.06
No	130	0.02		0.02		0.02	
Yes	48	-0.06		-0.05		-0.05	
Pregnancy Wastage			0.06		0.05		0.07
Never	158	0.01		0.01		0.01	
Ever	20	-0.07		-0.06		-0.09	
Family Main Occupation			0.14		0.16		0.18
Agriculture	138	-0.04		-0.04		-0.04	
Non-Agriculture	40	0.13		0.14		0.15	
Wife's Education			0.20		0.20		0.10
No schooling	20	-0.17		-0.20		-0.10	
-13 Years	13	-0.22		-0.19		-0.09	
Over 3 Years	145	0.04		0.05		0.02	
Multiple R Squared					0.070		0.164
Multiple R					0.265		0.405

Table 16: Analysis of Variance of Recent Fertility

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Main Effect	2.733	5	0.547	2.770	0.020
Use of Ground Water	0.156	1	0.156	0.790	0.376
Pregnancy Wastage	0.088	1	0.088	0.447	0.505
Family Main Occupation	0.934	1	0.934	4.733	0.031
Wife's Education	1.565	2	0.782	3.964	0.021
Covariates	3.662	5	0.732	3.711	0.003
Wife's Income	0.176	1	0.176	0.894	0.346
Family Income	0.109	1	0.109	0.554	0.458
Engagement in Secondary Occupation	0.254	1	0.254	1.286	0.259
Average Birth Interval	0.000	1	0.000	0.001	0.976
Family Planning Practice	2.759	1	2.759	13.980	0.000
2-Way Interactions	1.431	9	0.159	0.806	0.612
Explained	7.826	19	0.412	2.087	0.007
Residual	31.184	158	0.197		
Total	39.011	177	0.220		

Covariate Raw Regression Coefficient

Wife's Income	-0.000	Average Birth Interval	0.000
Family Income	-0.000	Family Planning Practice	0.272
Engagement in Secondary Occupation	0.081		

of children they desired, they subsequently had lower fertility than the latter. The difference between the two occupational groups is statistically significant.

As far as wife's education is concerned, in a rural village the great majority of people receive only primary education and those who are better off are likely to receive more education than those who are economically worse off. Data show that women who received more education had more fertility. This is not expected but can be explained by the fact that the better educated are also better off economically and are likely to have higher fertility. The difference in recent fertility between the two groups is statistically significant.

Insofar as the relationships of covariates and fertility are concerned, wife's income, family's income and average birth interval are negatively related to fertility but none of them is significantly related to fertility. However, practice of birth control is significantly related to recent fertility. Those who practise family planning have lower recent fertility than those who do not.

Chapter IV

Conclusion and Recommendation

The use of ground water resources is a technological change in agricultural production, which increases the use of family labor. Data show that those who use ground water, despite their use of child labor, preferred a smaller family size than the non-users. Despite their higher cumulative fertility they stated they had fewer problems with their children.

The use of ground water not only increases more utilization of family members but also generates more family income and reduces fertility after it has been adopted. The ground water have a smaller number of children born three years ago. However as there are other factors affecting recent fertility, the difference in fertility between the ground water users and non users is not statistically significant. Some of these factors are female labor force participation and family planning practice.

In addition to its impact on fertility, the use of ground water is also associated with migration. It induces returned migration of the household members of the ground water users. At the same time, because of better financial conditions, the household members of the ground water users are in a better position to migrate out of their families to look for better economic opportunities elsewhere but they are less pressed to out-migrate than those who are non-users of ground water. The ground water users also need more labor to work on the farm. Consequently they hire more labor than the non-users.

The findings indicate the use of ground water is an attempt to relieve the pressure of population on land and to raise the standard of living of the people. In a sense, the use of ground water, fertility reduction and migration are part of multiphasic responses to demographic and economic change of the rural population. As such the following recommendations are proposed:

1. The use of ground water should be encouraged. Presently it is powered by gasoline. The recent oil crisis has led farmers to stop

multiple cropping and migrate to other areas. In some places it is difficult to acquire fuel. Thus, the introduction of electricity to the rural areas will help in reducing the cost of using ground water as it is cheaper than gasoline.

2. From the field survey it has been found that people lack knowledge of geology. Several of them invest money on drilling in vain. Thus it is recommended the government should bear the cost of a geological survey of ground water resources.

3. The government should promote the use of ground water, whenever it is feasible, by providing credits to the farmers so that they feel proud of being owners, rather than the government providing it for free. Farmers should also be encouraged to share the responsibility of taking care of the ground water wells.

4. In addition to promotion of ground water use, the government should pay attention to marketing, pricing and information related to the type of crops to be grown.

5. The government should also make a feasibility study and devise an appropriate mechanism to coordinate the use of ground water to avoid possible undesirable consequences resulting from the widespread use of ground water.

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SEAPRAP

THE SOUTHEAST ASIA POPULATION RESEARCH AWARDS PROGRAM

(Phased-out date: 31 May 1982)

PROGRAM OBJECTIVES

* To strengthen the research capabilities of young Southeast Asian social scientists, and to provide them with technical support and guidance if required.

* To increase the quantity and quality of social science research on population problems in Southeast Asia.

* To facilitate the flow of information about population research developed in the program as well as its implications for policy and planning among researchers in the region, and between researchers, government planners and policy makers.

ILLUSTRATIVE RESEARCH AREAS

The range of the research areas include a wide variety of research problems relating to population, but excludes reproductive biology. The following are some examples of research areas that could fall within the general focus of the Program:

* Factors contributing to or related to fertility regulation and family planning programs; familial, psychological, social, political and economic effects of family planning and contraception.

* Antecedents, processes, and consequences (demographic, cultural, social, psychological, political, economic) of population structure, distribution, growth and change.

* Family structure, sexual behaviour and the relationship between child-bearing patterns and child development.

* Inter-relations between population variables and the process of social and economic development (housing, education, health, quality of the environment, etc).

* Population policy, including the interaction of population variables and economic policies, policy implications of population distribution and movement with reference to both urban and rural settings, and the interaction of population variables and law.

* Evaluation of on-going population education programs and/or development of knowledge-based population education program.

* Incentive schemes — infrastructures, opportunities; overall economic and social development programs.

SELECTION CRITERIA

Selection will be made by a Program Committee of distinguished Southeast Asian scholars in the social sciences and population. The following factors will be considered in evaluating research proposals:

1. relevance of the proposed research to current issues of population in the particular countries of Southeast Asia;
2. its potential contribution to policy formation, program implementation, and problem solving;
3. adequacy of research design, including problem definition, method of procedure, proposed mode of analysis, and knowledge of literature;
4. feasibility of the project, including time requirement; budget; and availability, accessibility, and reliability of data;
5. Applicant's potential for further development.

DURATION AND AMOUNT OF AWARDS

Research awards will be made for a period of up to one year. In exceptional cases, requests for limited extension may be considered. The amount of an award will depend on location, type and size of the project, but the maximum should not exceed US$7,500.

QUALIFICATIONS OF APPLICANTS

The Program is open to nationals of the following countries: Burma, Indonesia, Kampuchea, Laos Malaysia, Philippines, Singapore, Thailand and Vietnam. Particular emphasis will be placed on attracting young social scientists in provincial areas.

Applications are invited from the following:

* Graduate students in thesis programs

* Faculty members

* Staff members in appropriate governmental and other organizations.

Full-time commitment is preferable but applicants must at least be able to devote a substantial part of their time to the research project. Advisers may be provided, depending on the needs of applicants.